

REMARKS

The rejection of Claims 1-10 under 35 U.S.C. § 103(a) as unpatentable over JP 200209643 (Takayama) and further in view of US 6,974,654 (Heishi), US 4,446,198 (Shemenski), and the Rubber Technology and Manufacture article (RTM), is respectfully traversed.

As recited in Claim 1, the invention is drawn to a composite material prepared by bonding rubber to the surface of a brass-plated material obtained by plating the surface of a substrate with brass or to the surface of a brass material by vulcanization, wherein needle-like Cu-S-based reaction products are formed at the bonding interface between brass and rubber, wherein preheating is carried out at 80 to 120°C before vulcanization, wherein when the section of the bonding interface between brass and rubber is observed through a transmission electron microscope, 1 to 50 needle-like Cu-S-based reaction products having a length L of 10 nm or more and a ratio of the length L to the width W (L/W) of 5 or more are existent based on 1  $\mu$ m in the length of the section of the bonding interface.

As described in the specification at the first full paragraph under “Detailed Description of the Preferred Embodiment,” at page 5, Applicants discovered that adhesion of brass to rubber can be improved due to the existence of needle-like Cu-S-based reaction products formed at the interface between brass plating and rubber after vulcanization which is carried out after a pre-heating step is carried out on an unvulcanized green tire at 80 to 120°C. In addition, and as described in the specification at page 6, first and second full paragraphs, only such needle-like reaction products having particular dimensions contribute to adhesion; similar reaction products of different size do not. Thus, Fig. 1A shows sizes that do contribute to adhesion to rubber; Figs. 1B and 1C show sizes that do not contribute to adhesion to rubber.

In addition, while preheating temperature is a necessary condition to form the desired Cu-S-based reaction products, it is not a sufficient condition. As described in the specification at page 8, lines 4-5, optimum conditions change according to the components and composition of a rubber compound. Thus, preheating time is a factor also. Indeed, as shown in Fig. 3 herein, 10 minutes of preheating at 100°C, followed by vulcanization at 160°C for 15 minutes, resulted in excellent adhesion to rubber, as described in the specification at page 8, first full paragraph. On the other hand, under the same conditions, except for preheating for 20 minutes, and as shown in Fig. 4, inferior results are obtained, as described in the specification at the paragraph bridging pages 8 and 9. Data for the conditions discussed above with regard to Figs. 3 and 4 appear in Table 1 for sample Nos. 6 and 11, respectively, which Table 1 is reproduced below. In all of the examples shown in Table 1, preheating, when carried out, was at 100°C, as described in the specification at page 11, second paragraph.

TABLE 1

No.	Preheating time (min)	Number of needle-like Cu—S-based reaction products based on 1 $\mu$ m in the length of the bonding interface	Initial adhesion	Long-term adhesion
1	0 (Not preheated)	None	100	100
2	2	0.2	101	103
3	4	1.2	120	122
4	6	2.1	131	130
5	8	3.5	142	141
6	10	5.2	150	150
7	12	15.5	153	151
8	14	22.5	140	142
9	16	32.2	133	131
10	18	45.5	121	120
11	20	53.2	101	99
12	22	64.5	98	100
13	24	72.2	97	98
14	26	80.5	98	99

The specification describes the above-results, at page 12, lines 1-9 below Table 1, and page 13, lines 1-5, as follows:

A composite material having **1 to 50 needle-like Cu-S-based reaction products** (based on 1  $\mu\text{m}$  in the length of the interface) has a **bonding strength of 120% or more**, a composite material having 2 to 40 needle-like Cu-S-based reaction products has a bonding strength of 130% or more, and a composite material having 3 to 30 needle-like Cu-S-based reaction products has a bonding strength of 140% or more. Therefore, it can be understood that they have **excellent adhesion to rubber**.

In contrast to these, a composite material having **less than 1 needle-like Cu-S-based reaction product** (No. 2) and a composite material having **more than 50 needle-like Cu-S-based reaction products** (Nos. 11 to 14) have the same or **lower bonding strength** than a composite material obtained without preheating.

(Emphasis added).

Thus, the present invention is not simply a recognition that needle-like Cu-S-based reaction products are obtained when preheating is carried out within the temperature range recited in the claims, but that other factors, such as the time of preheating, affects the size and number of such reaction products, and that adhesion is promoted only when reaction products having a particular size and a particular number are obtained.

One skilled in the art would have been without a clue of Applicants' discovery when considering the applied prior art, as now discussed.

Takayama discloses that overall curing time of a tire is reduced if the green tire is preheated before vulcanization, resulting in improved uniformity and quality of the tire. Applicants acknowledge that Takayama discloses the presence of a metal wire inside the unvulcanized tire, as pointed out by the Examiner. However, the purpose of the metal wire appears to be as the means which receives electromagnetic induction so as to heat the wire to a temperature of 80-120°C ([0014] and [0018]), so as to heat the tire. There is no disclosure or any recognition in Takayama that one effect of the preheating is to increase the adhesion between the metal wire and the rubber of the tire.

The Examiner relies on Heishi, Shemenski, and RTM for their respective disclosures that brass plating of tire cords is conventional. The Examiner then holds that it would have been obvious to brass plate the metal wire of Takayama.

In reply, since the purpose of the wire in Takayama appears to be as a conductor of heat, it is not clear why one skilled in the art would coat the wire with brass. Nevertheless, even if it were obvious to so coat the wire, the result would still not be the presently-claimed invention, since Takayama does not recognize that conditions associated with preheating, as well as the preheating *per se*, are result-effective variables in terms of increasing adhesion between rubber and brass. Thus, the present claims are patentable under the rationale of *In re Antonie*, 559 F.2d 618, 195 USPQ 6, 8-9 (CCPA 1977) (**copy enclosed**) (exceptions to rule that optimization of a result-effective variable is obvious, such as where the results of optimizing the variable are unexpectedly good or where the variable was not recognized to be result effective). Applicants are entitled to prevail under either of the above exceptions.

In the Response to Arguments, beginning at page 4 of the Office Action, the Examiner finds that the presently-recited needle-like reaction products “appear to naturally result” from preheating a brass coated metal wire at 80-120°C.

In reply, and as discussed above, preheating within that temperature range is a necessary, but not a sufficient, condition. Moreover, while there is precedent supporting the notion, as cited by the Examiner, that the recognition of another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious, that is not the present case, since the present invention is more than simply following suggestions of the prior art.

The Examiner finds that the results in above-discussed Table 1 “suggest that an assembly preheated for 20 minutes is substantially the same as an assembly preheated up to

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26 minutes (long term adhesion is actually the same or better at 2 of the 3 experimental times).”

In reply, the Examiner’s finding actually makes Applicants’ point. Both sample No. 11, which had a preheating time of 20 minutes, and sample No. 14, which had a preheating time of 26 minutes, are both outside the terms of the present claims, because the number of needle-like Cu-S based reaction products of required size are above the presently-recited maximum of 50.

Finally, the Examiner finds that “it is art recognized that bonding between brass coated reinforcing elements and rubber reaches a maximum during heating or vulcanization and additional heating actually degrades the bond,” relying on Shemenski et al (column 1, lines 30-45).

In reply, the disclosure relied on by the Examiner is with regard to vulcanization, not preheating. It is thus irrelevant.

For all the above reasons, it is respectfully requested that the rejection be withdrawn.

All of the presently-pending claims in this application are now believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

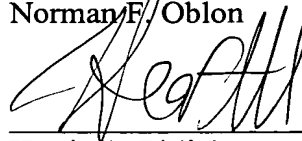
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Respectfully submitted,

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**FULL TEXT OF CASES (USPQ FIRST SERIES)**

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IN RE ANTONIE 195 USPQ 6 (CCPA 1977)

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**In re Antonie****(CCPA)****195 USPQ 6****Decided Aug. 18, 1977****No. 76-681****U.S. Court of Customs and Patent Appeals**

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**Headnotes****PATENTS****1. Patentability -- Invention -- In general (§ 51.501)**

Court of Customs and Patent Appeals must first delineate invention as whole in determining whether invention as whole would have been obvious under 35 U.S.C. 103; it looks not only to subject matter that is literally recited in claim in question but also to those properties of subject matter that are inherent in subject matter and are disclosed in specification, in delineating invention as whole; just as chemical and its properties are looked to when obviousness of composition of matter claim is examined for obviousness, invention as whole, not some part of it, must be obvious under Section 103.

**2. Patentability -- Invention -- In general (§ 51.501)**

Controlling question in determining obviousness is simply whether differences between prior art and invention as whole are such that invention as whole would have been obvious.

**3. Patentability -- Invention -- In general (§ 51.501)**

Standard of 35 U.S.C. 103 is not that it would be obvious for one of ordinary skill in art to try invention; disregard for unobviousness of results of "obvious to try" experiments disregards "invention as a whole" concept of Section 103, and overemphasis on routine nature of data gathering required to arrive at applicant's discovery, after its existence became expected, overlooks last sentence of Section 103.

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**4. Patentability -- Change -- In general (§ 51.251)****Patentability -- Invention -- In general (§ 51.501)**

Exception to rule that discovery of optimum value of variable in known process is normally obvious occurs when parameter optimized was not recognized to be result effective variable.

**Particular patents -- Contactor Apparatus**

Antonie, Rotating Biological Contactor Apparatus, rejection of claims 1-3 reversed.

**Case History and Disposition:**

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**Appeal from Patent and Trademark Office Board of Appeals.**

Application for patent of Ronald L. Antonie, Serial No. 331,796, filed Feb. 12, 1973. From decision rejecting claims 1-3, applicant appeals. Reversed; Miller, Judge, concurring in result; Maletz, Judge, with whom Rich, Judge, joins, dissenting with opinion.

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**Attorneys:**

Arthur H. Seidel, Thomas W. Ehrmann, and Quarles & Brady, all of Milwaukee, Wis., for appellant.

Joseph F. Nakamura (R. D. Edmonds, of counsel) for Commissioner of Patents and Trademarks.

**Judge:**

Before Markey, Chief Judge, Rich, Baldwin, and Miller, Associate Judges, and Herbert N. Maletz, \* Associate Judge, United States Customs Court.

**Opinion Text****Opinion By:**

Baldwin, Judge.

This is an appeal from a decision of the Patent and Trademark Office (PTO) Board of  
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Appeals (board) affirming the rejection of claims 1, 2 and 3 of an application for "Rotating Biological Contactor Apparatus" <sup>1</sup> as obvious under 35 USC 103 in view of El-Naggar. <sup>2</sup> We reverse.

### The Invention

Appellant claims a wastewater treatment device in which wastewater is continuously passed through a tank. Semi-immersed contactors (disks) are continuously rotated to aerate their immersed portions and thereby to aerate both microorganisms that grow on the contactors and the wastewater itself. For this discussion, several variables are important in this device. "Throughput" is the volume of wastewater per unit time (gal./day) which the device must treat. "Contactor area" is the total area of the contactors which is exposed to the wastewater as the contactors are rotated (sq. ft.). "Tank volume" is the actual volume of liquid in the tanks in which the contactors rotate (gal.). The ratio of throughput to contactor area (gal./day/sq. ft.) is called the "hydraulic loading." Two concepts of effectiveness of the equipment are important in this discussion. The primary prior art reference uses the term "efficiency" to denote the percent impurity reduction which a given set-up of the device achieves and we shall so use the term. Appellant uses the term "maximum treatment capacity" to denote when a *unit of contactor area* is providing maximum "efficiency" for a given "throughput" or maximum "throughput" for a given "efficiency." It is essential to understand the distinction between "efficiency," a matter of ultimate effectiveness independent of the efficiency of the equipment, and "treatment capacity," a matter of the efficiency or effectiveness of a unit of contactor area. The latter is more properly associated with the normal use of the term "efficiency" denoting maximum result from a limited resource.

Appellant's claimed device has a ratio of tank volume to contactor area of 0.12 gal./sq. ft. <sup>3</sup> Appellant maintains that this ratio is the most desirable or optimum for all set-ups of the device in the sense that using a lower value gives lower "treatment capacity" and using a greater value gives no increase in "treatment capacity," merely increasing costs. Thus, the value is optimum in that it maximizes "treatment capacity" so that the effectiveness of a given contactor is maximized.

### The Prior Art

El-Naggar teaches the basic structure of the device claimed by appellant but is silent regarding quantitative design parameters other than to give data on a single example, which data was apparently complete *except for any discussion of "tank volume."* El-Naggar stated the "efficiency" (obviously referring to the purity of the output) could be increased to 95% by increasing the area of the contactor.

### The Rejection

The examiner rejected the claims as obvious under 35 USC 103, noting that the basic device in question is old as taught by El-Naggar. While the ratio of tank volume to contactor area of 0.12 gal./sq. ft. is not disclosed in El-Naggar, the examiner reasoned that the disclosure of El-Naggar would make a device with that optimum value obvious. The examiner noted that El-Naggar suggests increasing the "efficiency" (degree of purification) of his device by increasing the contactor area while apparently keeping the "throughput" constant, that is, reducing the "hydraulic loading." The examiner then *assumed* that El-Naggar teaches keeping the tank volume constant while increasing the



contactor area. Thus, the examiner argued that the idea of increasing tank volume to surface area to increase efficiency is taught and that working out the value for optimum efficiency is mere mechanical experimentation. The board accepted the examiner's reasoning.

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### Opinion

[1] In determining whether the invention as a whole would have been obvious under 35 USC 103, we must first delineate the invention as a whole. In delineating the invention as a whole, we look not only to the subject matter which is literally recited in the claim in question (the ratio value) but also to those properties of the subject matter which are inherent in the subject matter *and* are disclosed in the specification. In *re Davies*, 475 F.2d 667, 177 USPQ 381 (CCPA 1973). In this case, the invention as a whole is the ratio value of 0.12 *and* its inherent and disclosed property. That property is that the described devices designed with the ratio will maximize treatment capacity regardless of the values of the other variables in the devices. Just as we look to a chemical and its properties when we examine the obviousness of a composition of matter claim, it is this invention *as a whole*, and not some part of it, which must be obvious under 35 USC 103. Cf. In *re Papesch*, 50 CCPA 1276, 315 F.2d 381, 137 USPQ 43 (1963).

[2] The controlling question is simply whether the differences (namely the value of 0.12 and its property) between the prior art and appellant's invention as a whole are such that appellant's invention as a whole would have been obvious. The answer is no. It is impossible to recognize, from the experiment taught by El-Naggar, that "treatment capacity" is a function of "tank volume" or the tank volume-to-contactor area ratio. Recognition of this functionality is essential to the obviousness of conducting experiments to determine the value of the "tank volume" ratio which will maximize treatment capacity. Such functionality can *only be determined* from data representing either efficiency at varying tank volume, fixed throughput, and fixed contactor area or throughput at varying tank volume, fixed efficiency, and fixed contactor area. Each of these experiments represents treatment capacity with fixed contactor area but varying tank volume. This sort of experiment would not be suggested by the teachings of El-Naggar since he was not trying to maximize or control "treatment capacity." The experiments suggested by El-Naggar do not reveal the property which applicant has discovered, and the PTO has provided us with no other basis for the obviousness of the necessary experiments.

[3] The PTO and the minority appear to argue that it would always be *obvious* for one of ordinary skill in the art *to try* varying *every* parameter of a system in order to optimize the effectiveness of the system even if there is no evidence in the record that the prior art recognized that particular parameter affected the result.<sup>4</sup> As we have said many times, *obvious to try* is not the standard of 35 USC 103. In *re Tomlinson*, 53 CCPA 1421, 363 F.2d 928, 150 USPQ 623 (1966). Disregard for the unobviousness of the results of "obvious to try" experiments disregards the "invention as a whole" concept of §103. In *re*

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Dien, 54 CCPA 1027, 371 F.2d 886, 152 USPQ 550 (1967) and In re Wiggins, 55 CCPA 1356, 397 F.2d 356, 158 USPQ 199 (1968), and overemphasis on the routine nature of the data gathering required to arrive at appellant's discovery, after its existence became expected, overlooks the last sentence of §103. In re Saether, 492 F.2d 849, 181 USPQ 36 (CCPA 1974).

[4]In In re Aller, 42 CCPA 824, 220 F.2d 454, 105 USPQ 233 (1955), the court set out the rule that the discovery of an optimum value of a variable in a known process is normally obvious. We have found exceptions to this rule in cases where the results of optimizing a variable, which was known to be result effective, were unexpectedly good. In

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re Waymouth, 499 F.2d 1273, 182 USPQ 290 (CCPA 1974); In re Saether, supra. This case, in which the parameter optimized was not recognized to be a result-effective variable, is another exception. The decision of the board is reversed.

### Footnotes

Footnote 1.

Serial No. 331,796, filed February 12, 1973.

Footnote 2. "Method of Treatment of Sewage by Bio-Oxidation and Apparatus Therefor," U.S. Patent No. 3,335,081, issued August 8, 1967.

Footnote 3. Claims 1 and 2 recite "at least about 0.12" while claim 3 recites "about 0.12."

Footnote 4. The precise nature of the El-Naggar experiment and the nature of the data which would result are rendered hopelessly speculative by El-Naggar's total failure to discuss the critical matter of what is done with the volume of the tank. The PTO appears to assume, as a necessary element of its conclusion, that appellant's ratio is the inevitable result of El-Naggar experiment, and that the tank volume is fixed, apparently because El-Naggar does not suggest changing the tank as additional contactor area is supplied. Even if the same tank were used, the actual liquid volume of the tank could change significantly if 1) the tank has a level control, 2) the tank is not extremely large in comparison to the contactors and 3) the volume-to-area ratio of the contactors themselves is significant. Since these assumptions are not unreasonable, there is serious doubt as to the constant volume of the tank.

Whether one would inevitably arrive at the ratio value of 0.12 or above depends on facts which must be read into El-Naggar, (e.g., the volume of the tank) and on assumptions about the kind of motivation (e.g., the degree of "efficiency" which would be sought). All of this involves, at least on this record, mere speculation. Assuming, as the examiner has, that the tank volume is fixed and the natural motivation is to maximize efficiency, if El-Naggar's equipment has a tank volume to contactor area ratio of less than 0.12, and the resulting efficiency is found wanting, increasing the contactor area to increase "efficiency" will lead away from the claimed ratio.

### Dissenting Opinion Text

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**Dissent By:**

Maletz, Judge, with whom Rich, Judge, joins, dissenting.

With all due respect, I cannot agree with the majority's interpretation of the El-Naggar patent. El-Naggar discloses the same wastewater treatment apparatus as claimed, except for the specific volume-to-surface ratio of .12 gallons per square foot as recited in the claims. However, El-Naggar generally discloses varying the number of disks (column 3, lines 31-35), the number of concentric cylinders (column 4, lines 27-30), or the length of the cylinders (column 4, lines 61-62) in his apparatus in order to optimize results. Given the basic apparatus of El-Naggar and the concept of varying the number of disks in a tank in order to optimize impurity removal, I believe that it would have been well within the capabilities of the chemical engineer of ordinary skill to determine empirically, by routine experimentation, the optimum design ratio which appellant has determined and recited in his claims. That is, El-Naggar set the way, and appellant's work was what any routineer would have accomplished in following the patent teachings.

Appellant urges that the results which he determined empirically by plotting the effect of volume-to-surface ratio on impurity removal, including the specific, optimum design ratio of .12 gallons per square foot, could not have been predicted from El-Naggar. However, obviousness under 35 USC 103 does not require absolute predictability. In re Kronig, 539 F.2d 1300, 190 USPQ 425 (CCPA 1976), and it is sufficient here that El-Naggar clearly led the way for the routineer to arrive at the claimed apparatus.

I am in substantial agreement with the board's analysis of this case, and I would affirm the board's decision.

Footnote \* Judge of the United States Customs Court sitting by designation pursuant to 28 U.S.C. 293(d).

- End of Case -